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Efforts were devoted to the mathematical analysis of problems arising in continuum mechanics. Most of the problems considered were dynamic and involved nonlinear partial differential equations of integrodifferential equations. Specific areas of study include viscoelasticity, thermoelasticity. Three graduate students who have worked on Ph.D theses under the supervision of W. Hrusa have received partial support.

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Final Technical Report
for Grant No. AFOSR-85-0307

Project Title: Some Mathematical Problems in Continuum Mechanics

Reporting Period: 9/30/85 to 9/29/88

Principal Investigator: William J. Hrusa

Efforts were devoted to the mathematical analysis of problems arising in continuum mechanics. Most of the problems considered were dynamic and involved nonlinear partial differential equations or integrodifferential equations. Specific areas of study include viscoelasticity, thermoelasticity, hyperbolic models for heat conduction, and thermoviscoelasticity. Three graduate students who have worked on Ph.D. theses under the supervision of W. Hrusa have received partial support.

Publications prepared with partial support from AFOSR-85-0307

1. M. Renardy, W.J. Hrusa, and J.A. Nohel, *Mathematical Problems in Viscoelasticity*, Longman Scientific and Technical, Essex (England), and John Wiley and Sons, New York, 1987.

2. W.J. Hrusa and M. Renardy, An existence theorem for the Dirichlet problem in the elastodynamics of incompressible materials, *Arch. Rational Mech. Anal.* **102** (1988), 95-117.

3. B.D. Coleman, W.J. Hrusa, D.C. Newman, and D.R. Owen, Nonlinear effects associated with second sound in solids, Proceedings of the International Meeting on Macroscopic Superfluids (*Accademia Nazionale dei Lincea*) (to appear).

4. W.J. Hrusa and M. Renardy, A model equation for viscoelasticity with a strongly single kernel, *SIAM J. Math. Anal.* **19** (1988), 257-269.

5. W.J. Hrusa and M. Renardy, A model problem in one-dimensional viscoelasticity with a singular kernel, Proceedings of International Conference on Volterra Integrodifferential Equations in Banach Spaces and Applications, *Longman Scientific and Technical Research Notes* (to appear).

6. M.E. Gurtin and W.J. Hrusa, On energies for nonlinear viscoelastic materials of single-integral type, Q. Appl. Math. 46 (1988), 381-392.

7. D. Brandon and W.J. Hrusa, Construction of a class of integral models for heat flow in materials with memory, J. Integral Equations Appl. (to appear).

8. M.E. Gurtin and W.J. Hrusa, On the thermodynamics of viscoelastic materials of single-integral type (preprint).

9. W.J. Hrusa, Some remarks on the Cauchy problem in one-dimensional nonlinear viscoelasticity (preprint).

10. W.J. Hrusa, J.A. Nohel, and M. Renardy, Initial value problems in one-dimensional nonlinear viscoelasticity App. Mech. Rev. 41 (1988), 371-378.

11. D. Brandon, Global existence and asymptotic stability for a nonlinear integrodifferential equation modeling heat flow (preprint).

12. W.J. Hrusa and M. Tarabek, On smooth solutions of the Cauchy Problem in one-dimensional nonlinear thermoelasticity, Q. Appl. Math. (to appear).

13. W.J. Hrusa and S. Messaoudi, On formation of singularities in one-dimensional nonlinear thermoelasticity (preprint).

Students Supported by AFOSR-85-0307

The following Ph.D. students of W. Hrusa have received partial support:

1. Deborah Brandon (Ph.D. May 1988). Ms. Brandon wrote her thesis on heat flow in nonlinear materials with memory. She worked on the construction of models ~~and she established~~ global existence and asymptotic stability for several associated initial value problems. Her thesis was successfully defended in April 1988. She accepted a postdoctoral position at the Institute for Mathematics and Applications at Minnesota (starting September 1988).

2. Micahael Tarabek (fifth year graduate student). Mr. Tarabek is working on nonlinear thermoelasticity when heat conduction is governed by Cattaneo's relation rather than Fourier's law. He has derived the thermodynamical restrictions on the constitutive equations, and he has established global existence and asymptotic stability for a one-dimensional body with pinned and insulated boundary, and for the one-dimensional Cauchy Problem. I expect him to receive his Ph.D. in May 1989.

3. Salim Messaoudi (fourth year graduate student). Mr. Messaoudi is working on nonlinear thermoelasticity. He has established some results concerning local existence in three spatial dimensions and formation of singularities in one spatial dimension. I expect him to receive his Ph.D. in 1989.